APPENDIX A

Maps

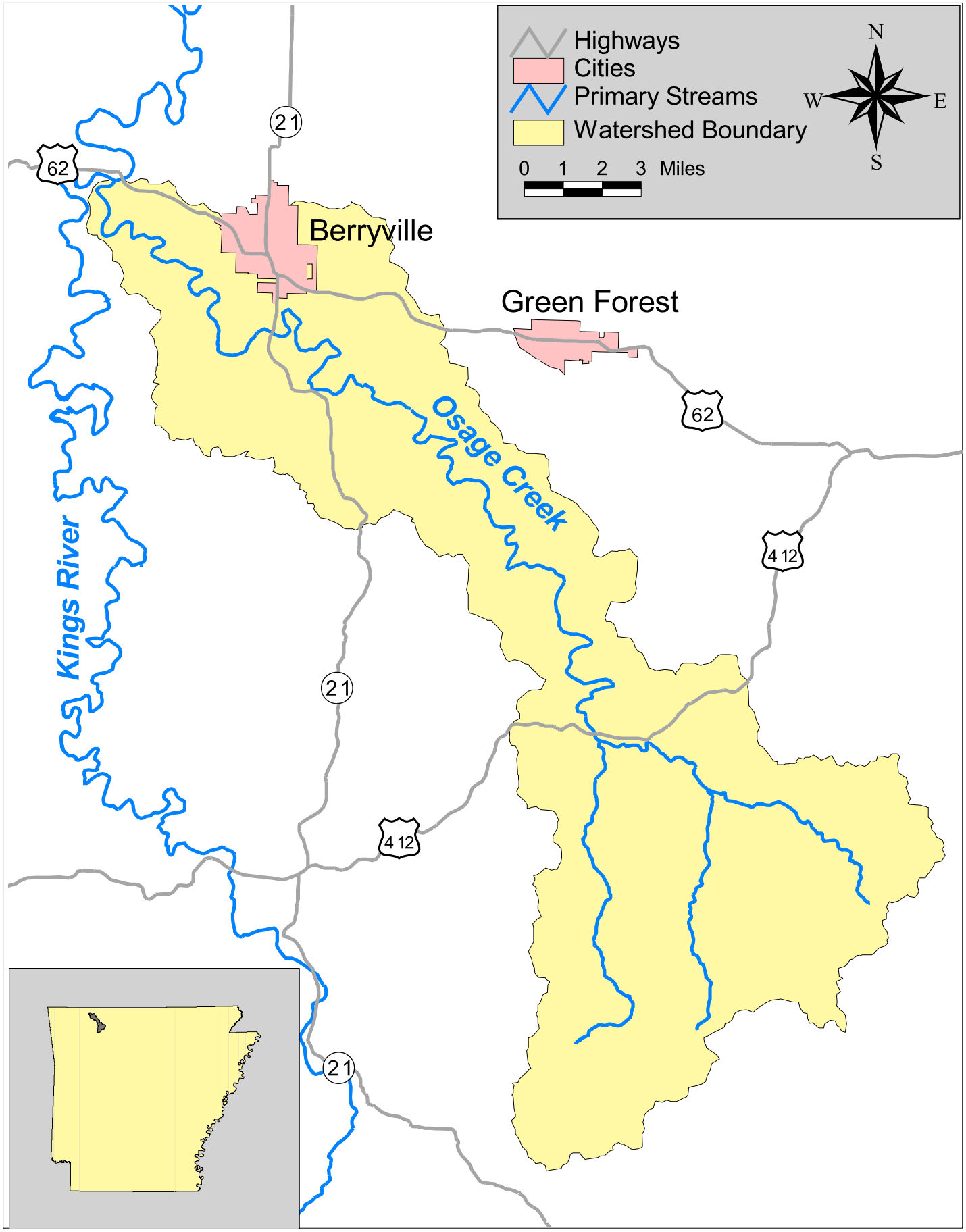


Figure A.1. Map of study area.

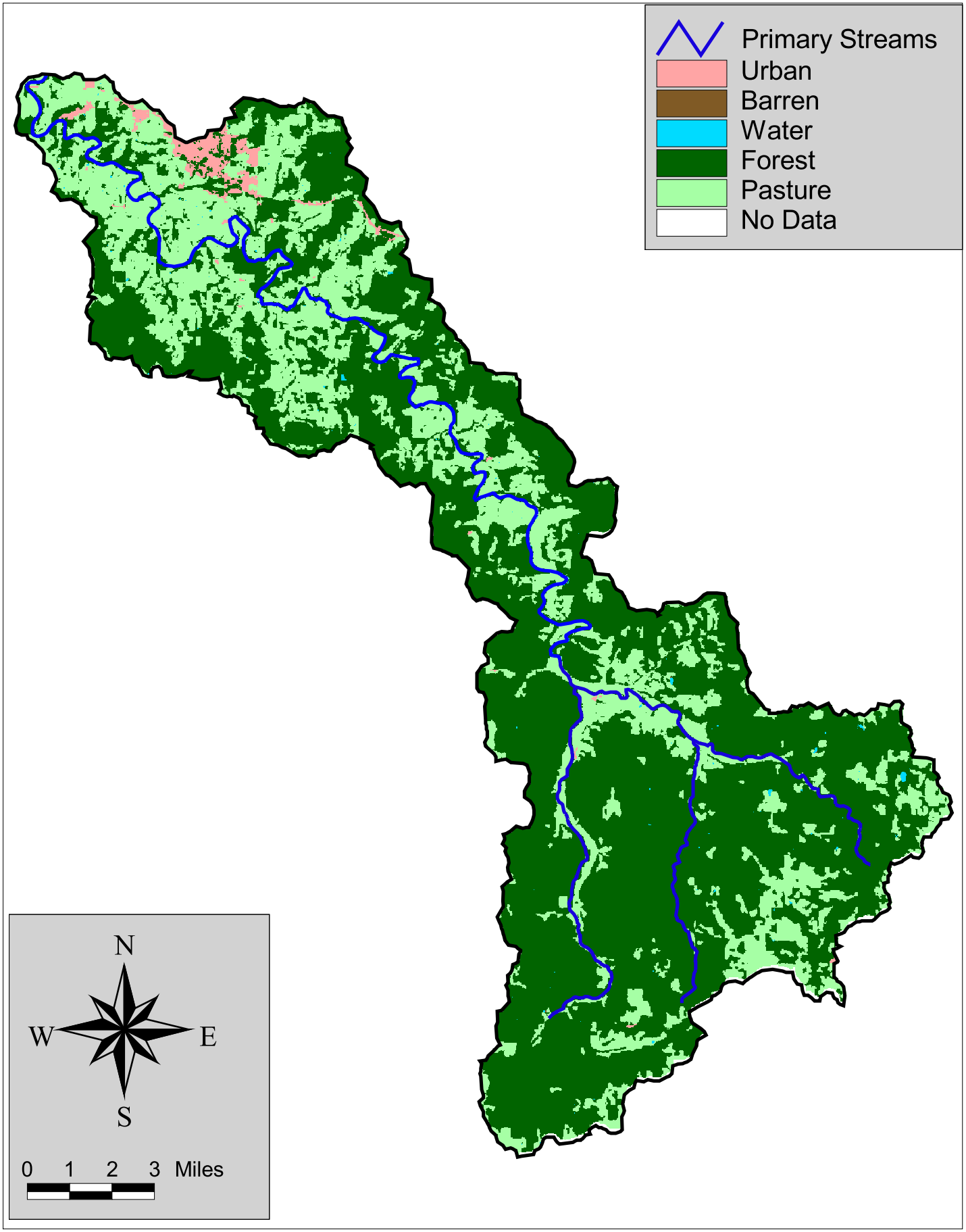


Figure A.2. Land use/land cover for study area.

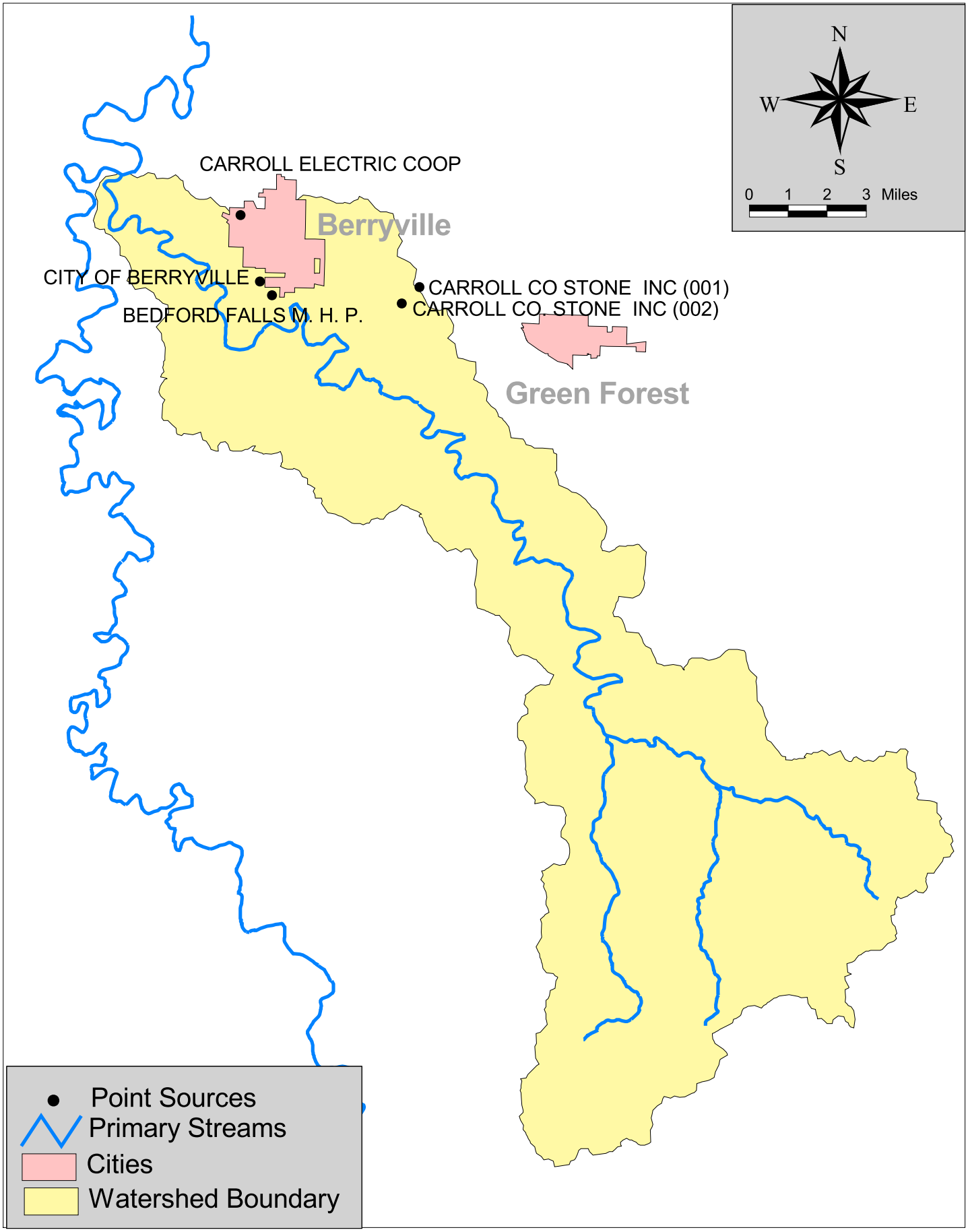


Figure A.3. Point sources in study area.

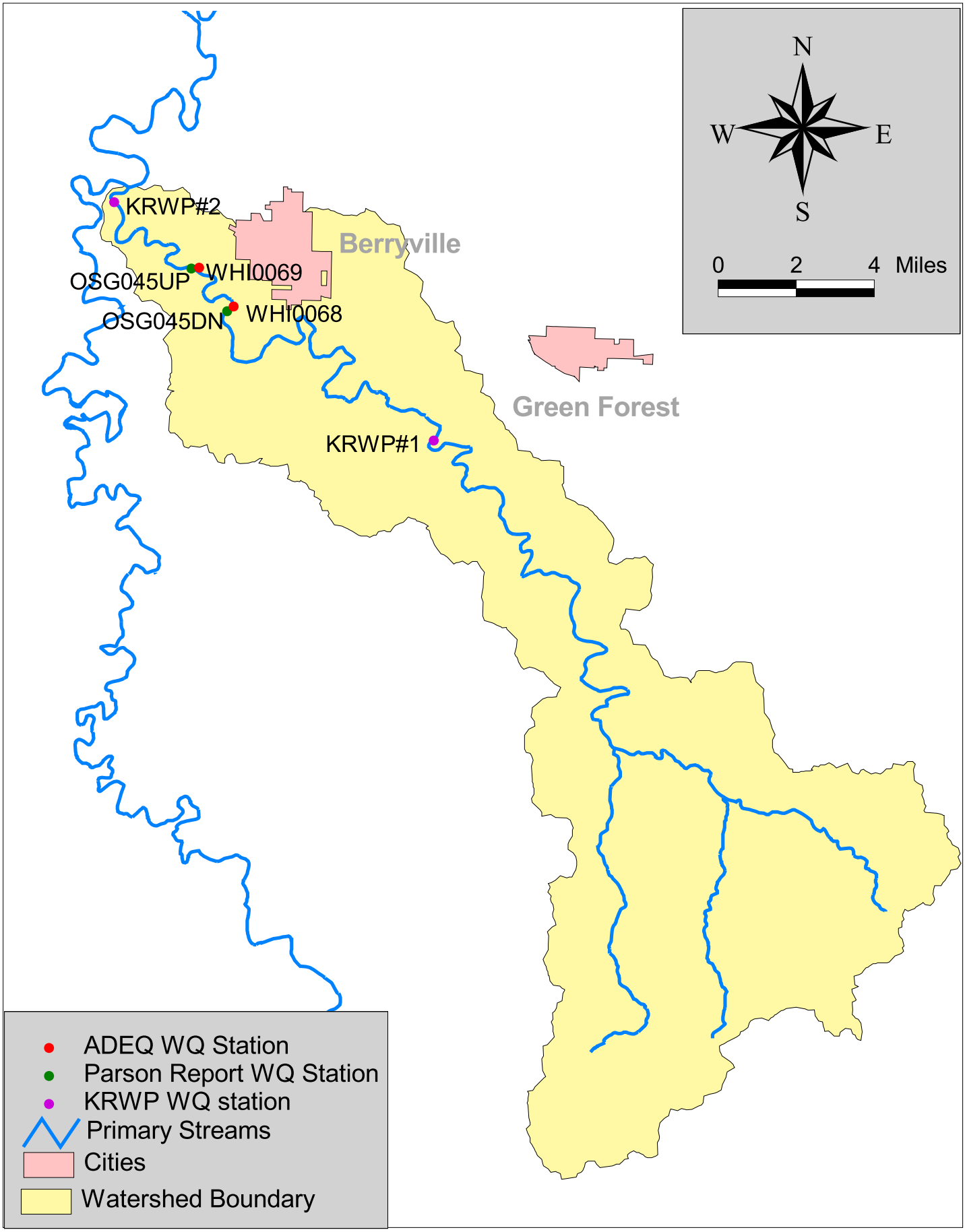


Figure A.4. Map of water quality stations in study area.

APPENDIX B

Total Phosphorus Plots

Figure B.1. Long Term Total P for Osage Creek above Berryville (WHI0068)

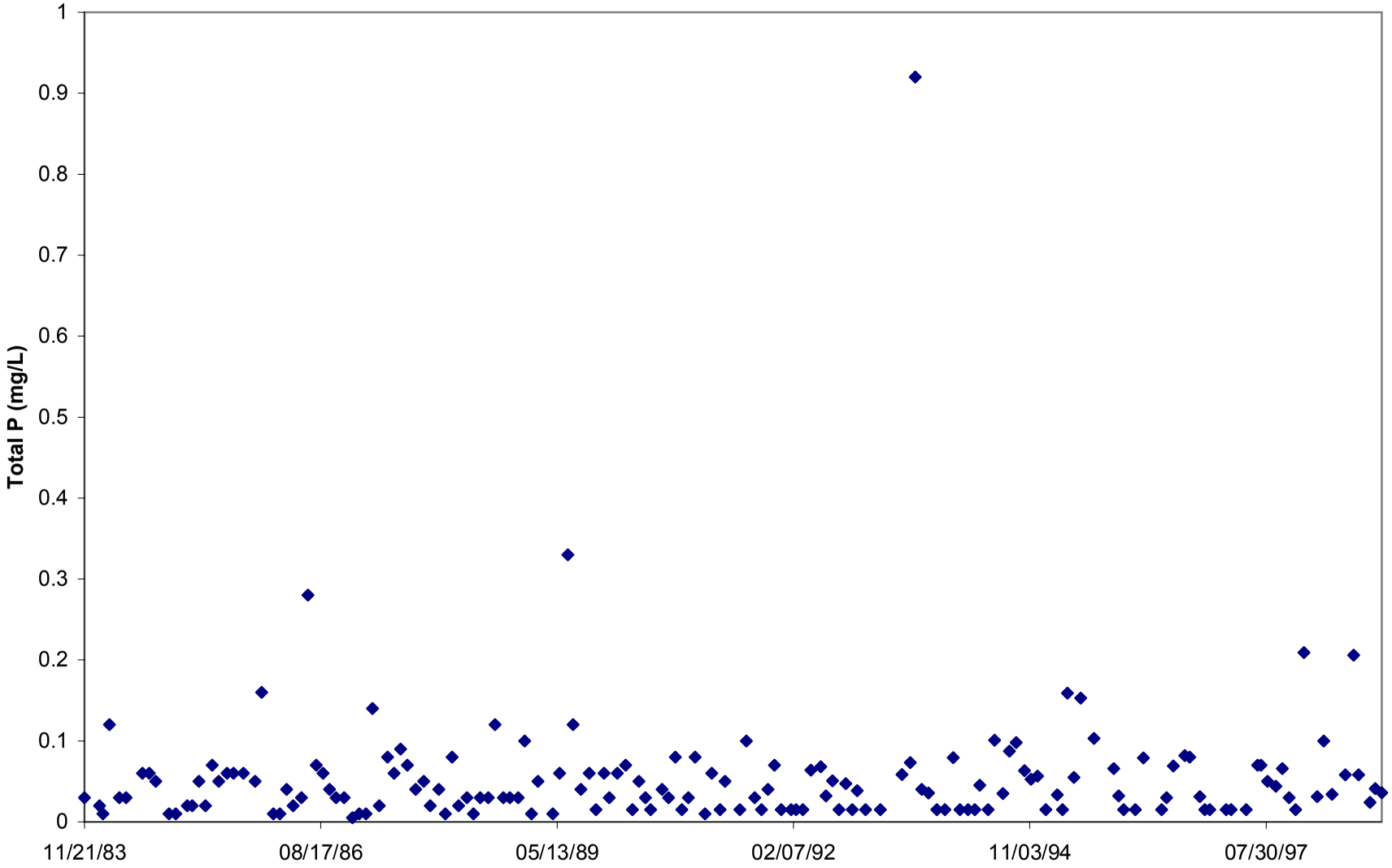


Figure B.2. Long Term Total P for Osage Creek below Berryville (WHI0069)

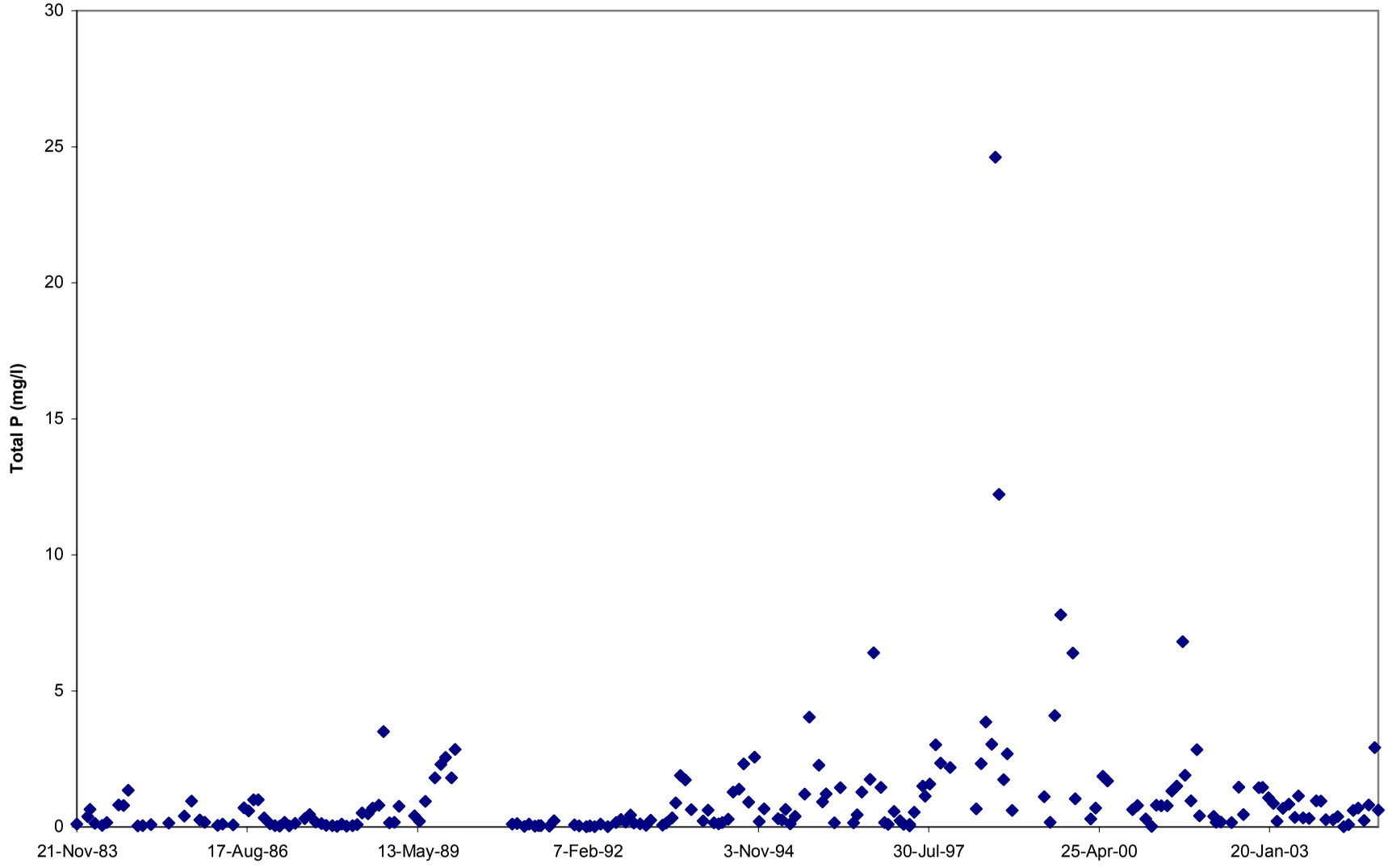


Figure B.3. Seasonal Total P for Osage Creek Above Berryville (WHI0068)

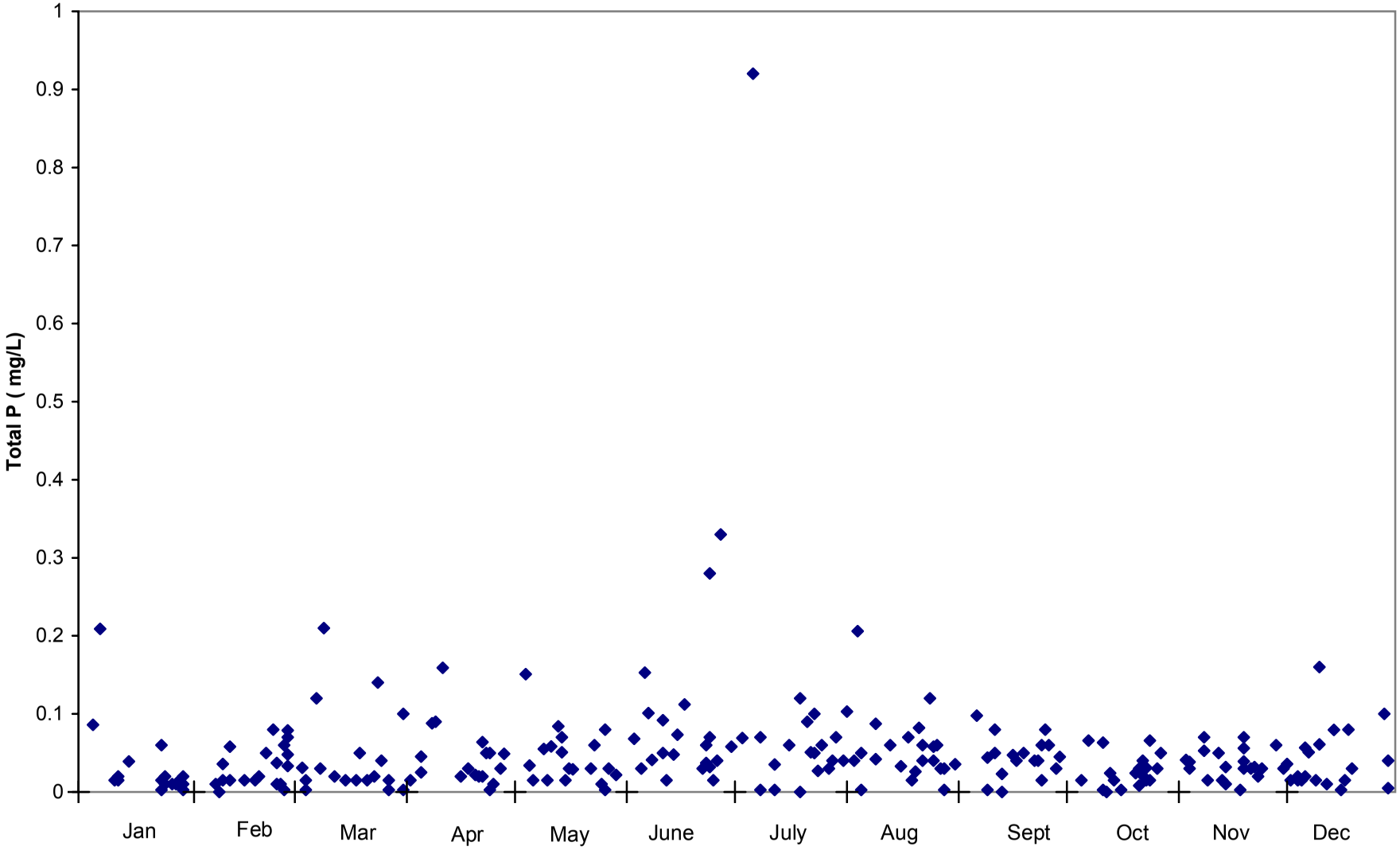


Figure B.4. Seasonal Total P for Osage Creek below Berryville (WHI0069)

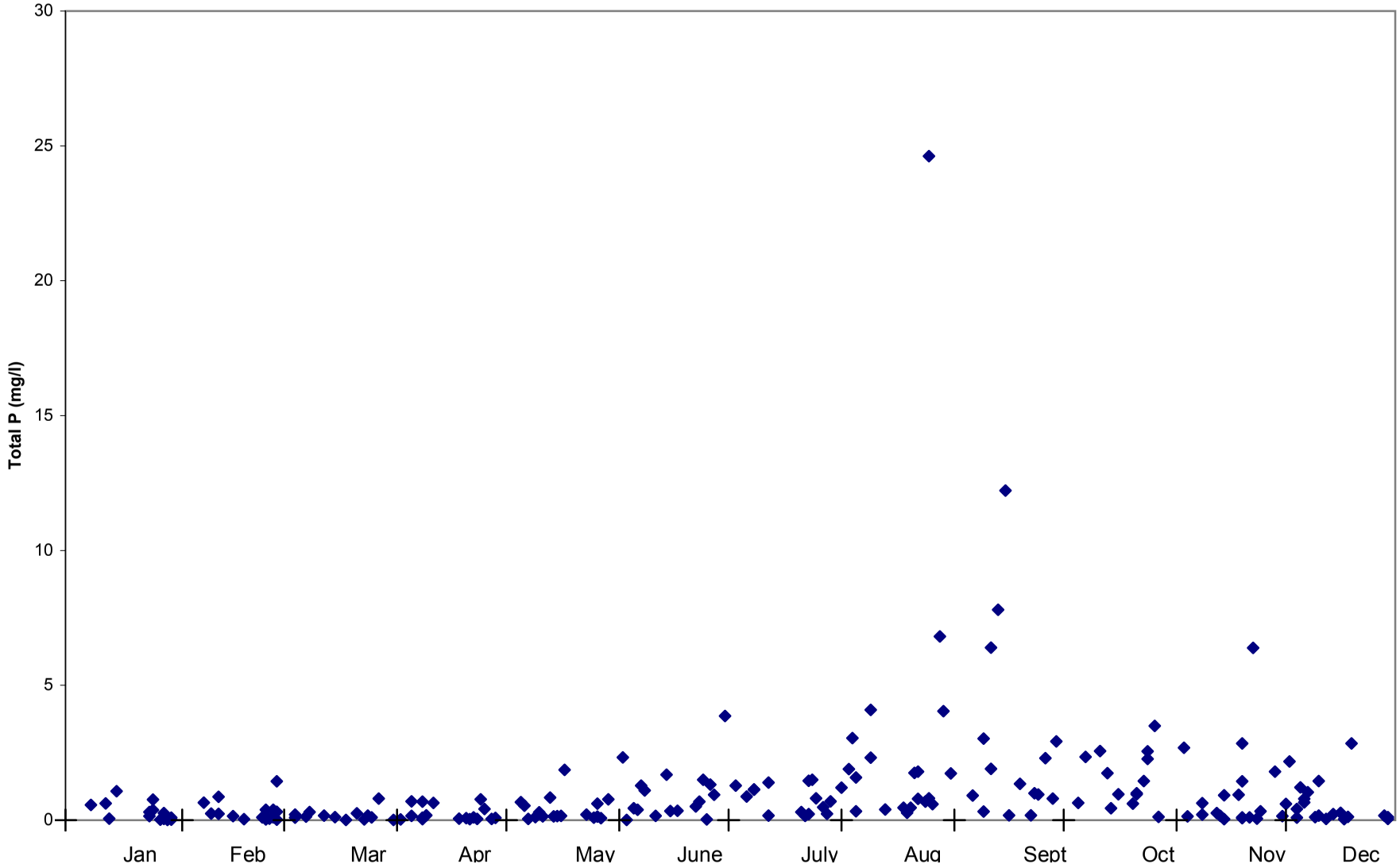


Figure B.5. Observed Phosphorus at KRWP Site 1: Upper Osage Creek at CR 702 above Berryville

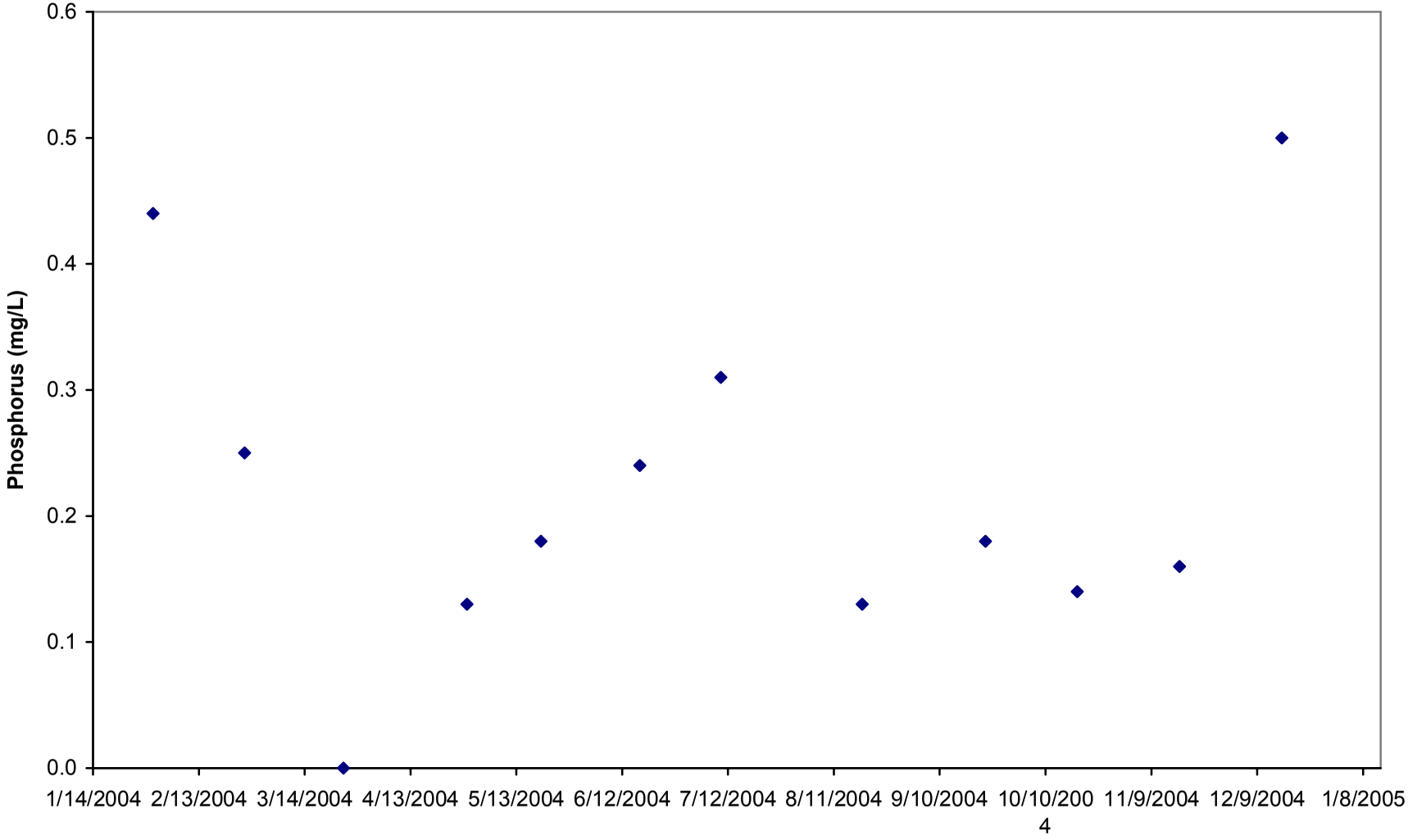


Figure B.6. Observed Phosphorus at KRWP Site 2: Lower Osage Creek at CR 306 below Berryville

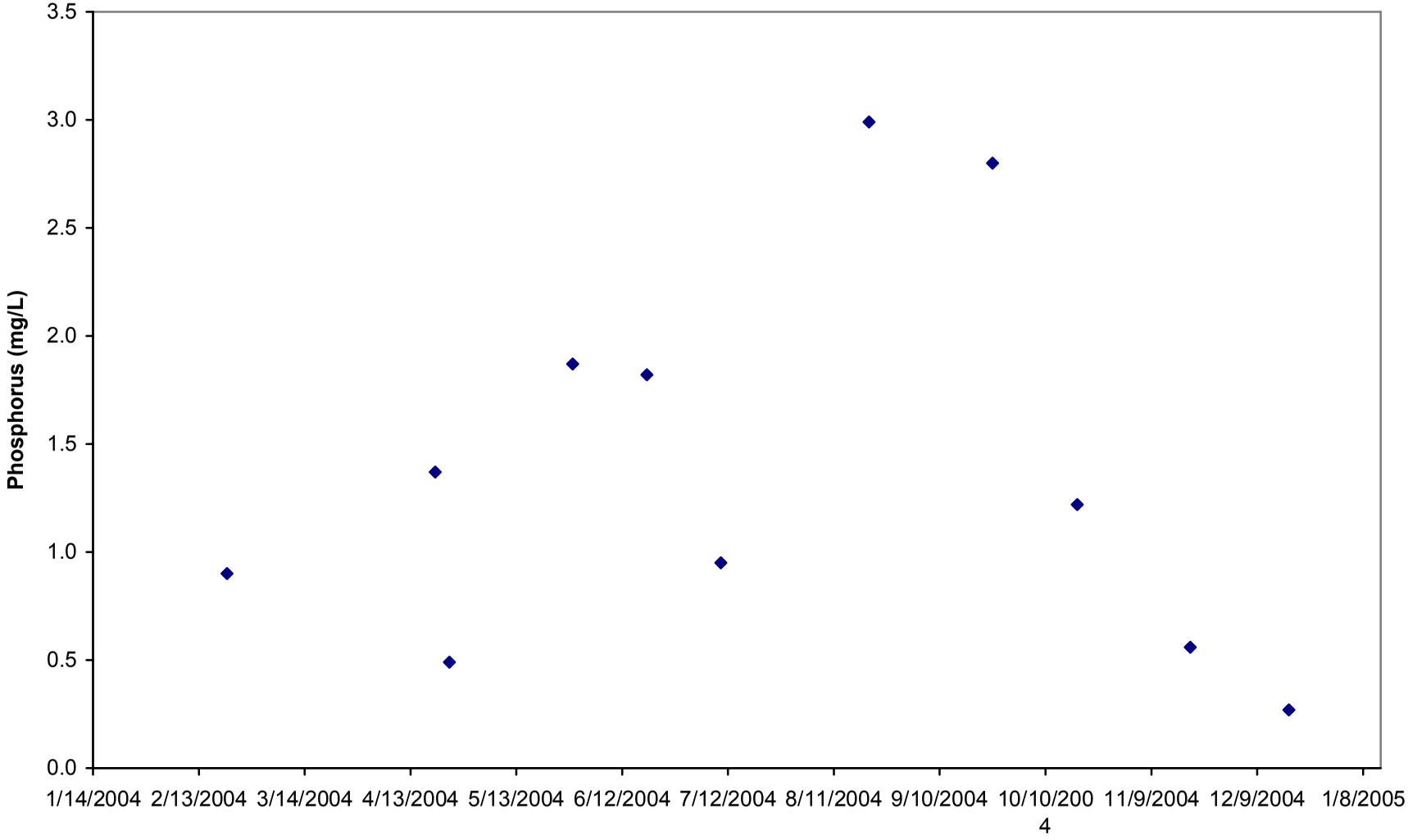


Figure B.7. Flow vs Total Phosphorus on Osage Creek above Berryville, AR (WHI0068)

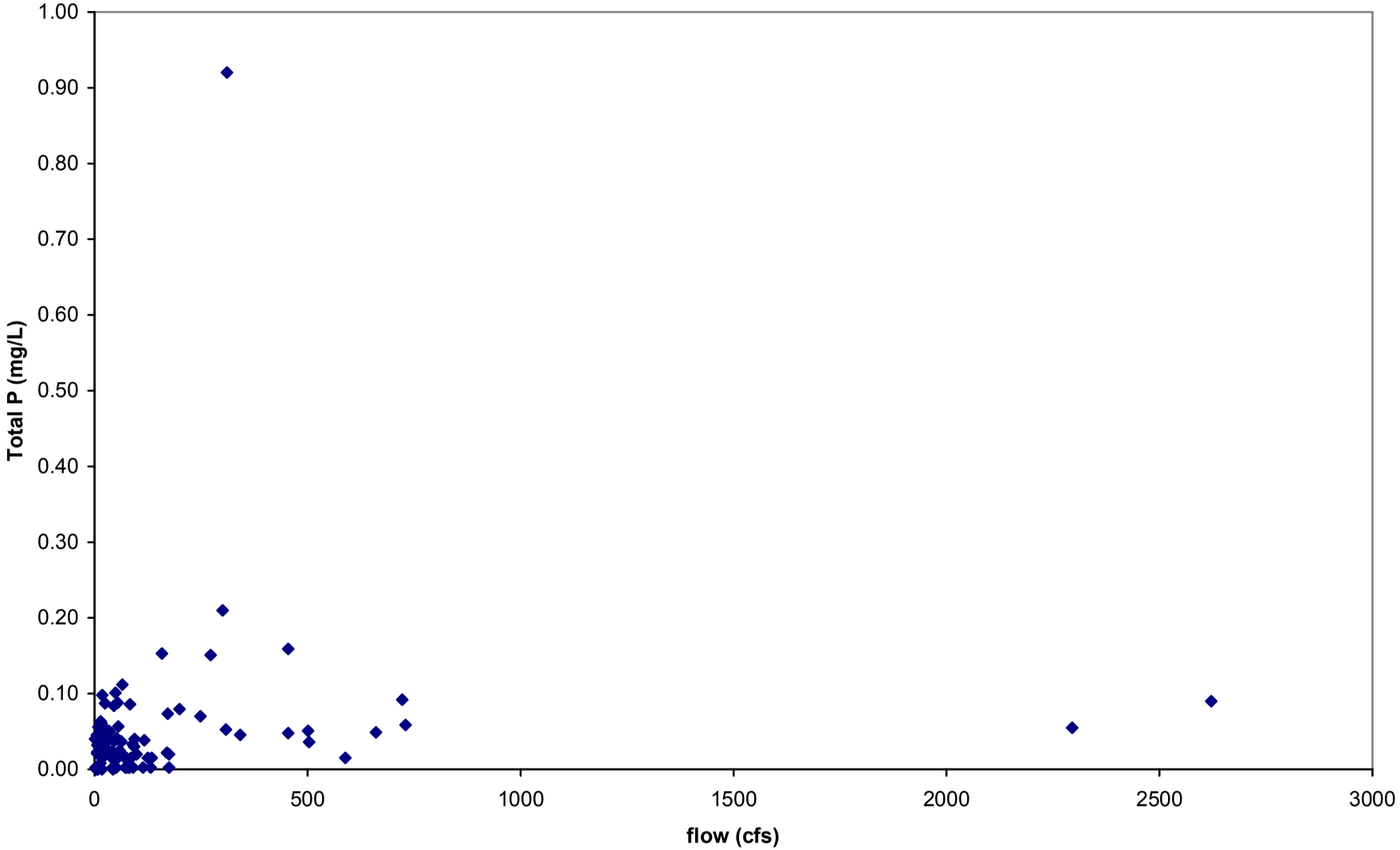
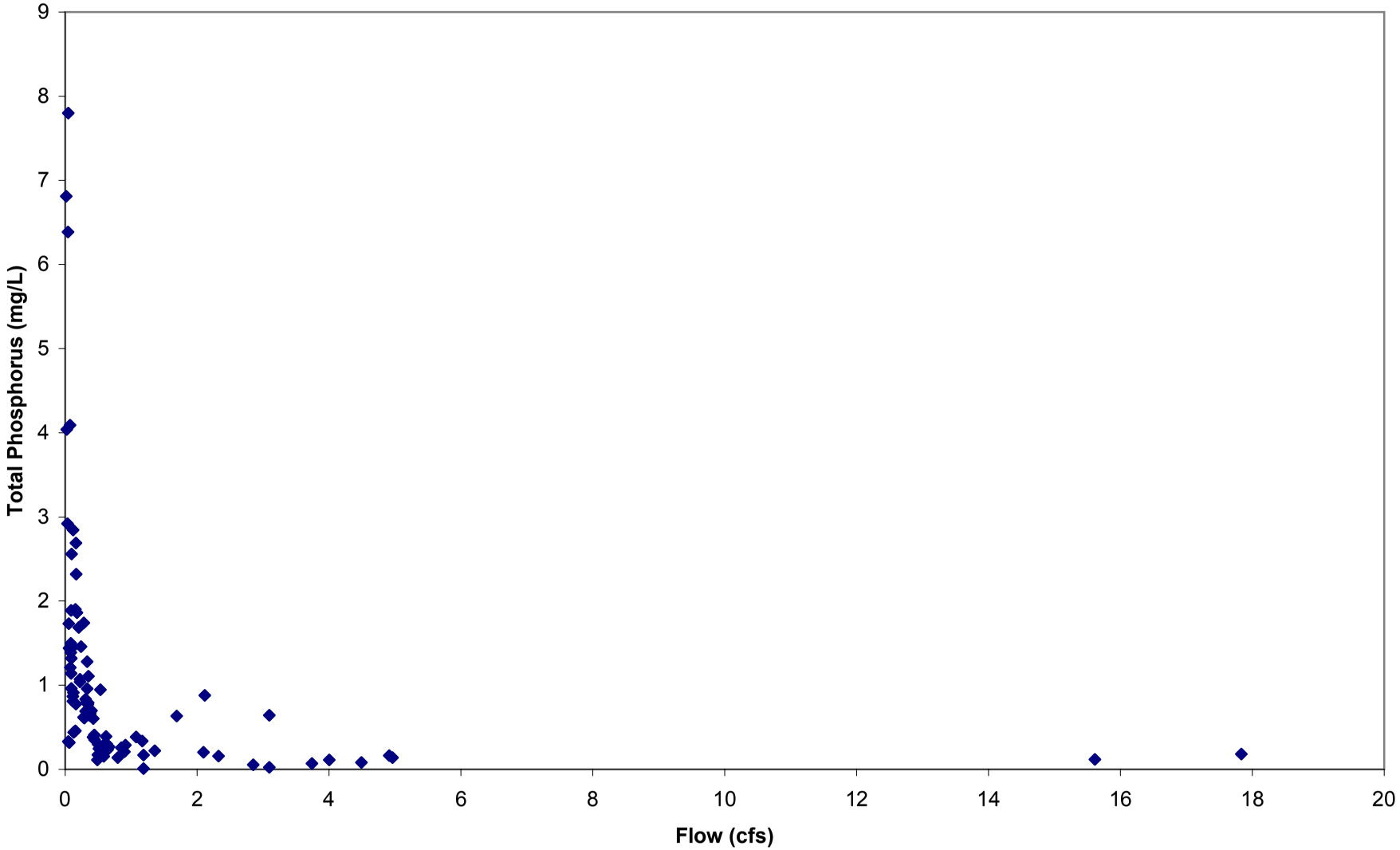


Figure B.8. Total Phosphorus vs Flow for Osage Creek Below Berryville, AR (WHI0069)



APPENDIX C

Public Comments and Responses

PUBLIC COMMENTS AND RESPONSES
TMDL FOR PHOSPHORUS IN OSAGE CREEK NEAR BERRYVILLE, AR
January 10, 2006

Comments that were received by EPA during the public comment period are shown below with EPA responses inserted in a different font.

COMMENTS FROM TYSON FOODS, INC.:

The Arkansas Department of Environmental Quality (ADEQ) recently published proposed changes to the Impaired Waterbodies List (303d list) on February 20, 2005. Since that time, the Arkansas information has been forwarded to EPA. Currently, EPA Region 6 has prepared 43 TMDLs and the calculations for these TMDLs for waters listed in the state of Arkansas under section 303(d) of the Clean Water Act (CWA). EPA is allowing comments on the 43 proposed TMDLs until December 12, 2005.

Tyson Foods (Tyson) is respectfully submitting this letter to offer comments regarding one of the streams included on the proposed 303(d) list. This stream is the Osage Creek which is located near a Tyson processing facility in Berryville, AR.

Tyson provides comments concerning Phosphorus as follows:

The basis for the phosphorus target for the TMDL is not a valid numerical water quality standard and is not a scientifically derived implementation of a narrative water quality standard. The 0.1 mg/L phosphorus target is not supported in the Arkansas standards. As acknowledged in the TMDL the 0.1 mg/L total phosphorus value was removed from the water quality standards. The value has never been a water quality standard but rather was used as a "guideline" for certain waters of the state. The 0.1 mg/L phosphorus target is not technically defensible. EPA supports the idea that the 0.1 mg/L target is not appropriate in all Ecoregions in Arkansas (EPA Rationale for making Listing Decisions, Region 6). In their Rationale for Listing Decisions, EPA states that "EPA did not believe that application of the guideline values (i.e., the 0.1 mg/L phosphorus guideline for streams) was an appropriate approach."

The TMDL acknowledges that the 0.1 mg/L phosphorus guideline does not currently exist, but states that "it is still a reasonable benchmark for evaluating phosphorus levels in streams for the protection of aquatic life." This assumption is incorrect as there is no documented relationship between 0.1 mg/L phosphorus and protection of aquatic life that could be applied in Osage Creek. This point is further illustrated by the ADEQ in their public response to comments made in the April 9, 2004 Responsiveness Summary to Comments received from the Public Concerning proposed Changes to Regulation No. 2. In this document the ADEQ states that "Based on years of water division field data, the relationship between nutrient concentration and impairment is not necessarily directly correlated for streams. Therefore, at this time we believe numeric criteria are not

appropriate." Furthermore, in their amendments to Regulation No. 2 the ADEQ has added language for determining impairments due to nutrients that considers factors such as "water clarity, periphyton or phytoplankton production, dissolved oxygen values, dissolved oxygen saturation, diurnal dissolved oxygen fluctuations, pH values, aquatic life community structure and possibly others." None of the listed determining factors were considered in the development of the TMDL target. Therefore, based on the latest regulations of the ADEQ with input from EPA, the target for this TMDL is outdated and technically inappropriate. Without a valid phosphorus target as the basis for the TMDL, the resulting TMDL must also be invalid.

There has been no substantiated scientific link made between phosphorus levels and aquatic life impairment. In addition, there are several examples of streams in Arkansas that have phosphorus levels above 0.1 mg/L and still maintain all aquatic life uses (good fish and macroinvertebrate communities). For example, collections completed in the Illinois River near the Oklahoma State Line and on Osage Creek downstream from phosphorus discharges all were found to have good communities of macroinvertebrates with total phosphorus concentrations exceeding 0.2 mg/L on average (ADPC&E, 1997). Two stations on Osage Creek (OSG03 and OSG04) even exhibited total phosphorus levels averaging 0.4 mg/L or higher during the study period, yet still contained good macroinvertebrate communities (ADPC&E, 1997). The Parsons/EPA study (EPA, 2004) cites several indicators of aquatic life impairment (diurnal dissolved oxygen fluctuation, supersaturated oxygen levels, minimum dissolved oxygen levels, etc.). These "indicators" could be signs of increased algal productivity (though not demonstrated in the studies, as no downstream impact to periphyton community was found) resulting from nutrient enrichment, but they are not direct indicators of aquatic life impairment, and no linkage is made.

Response: The TMDL in this report is being established to maintain Arkansas' narrative criteria for nutrients. Establishing a TMDL to comply with narrative criteria requires the development of a numeric endpoint. The endpoint for this TMDL is an estimate of the phosphorus that the stream can have and still maintain the aquatic life designated use. The 0.1 mg/L endpoint used in this TMDL was considered by EPA to be a reasonable goal that is not overly stringent. If a more appropriate numeric endpoint is developed in the future, this TMDL can be revised at that time.

EPA agrees with the statements above that aquatic life impairments are usually due to a number of other factors in addition to phosphorus concentrations. The list of factors quoted above is presented in Regulation 2 for the purpose of determining impairment rather than developing TMDLs. The determination of impairment for this stream did rely on several different factors as documented in EPA's Decision Document for the Final 2002 Section 303(d) List for Arkansas (EPA 2003). The TMDL in this report is

focused on phosphorus concentration as the endpoint rather than on other indicators of aquatic life impairment (e.g., large diurnal fluctuations of DO and pH, etc.) because the 303(d) listing for this stream cited phosphorus as the major cause of impairment. Other indicators of aquatic life impairment are often the result of elevated phosphorus concentrations.

The comments above state that aquatic life is not impaired in some streams that have phosphorus concentrations above 0.1 mg/L, such as Osage Creek in the Illinois River basin. EPA disagrees with this specific example. EPA considers aquatic life to be impaired in Osage Creek in the Illinois River basin, as indicated by EPA's addition of that stream to the Arkansas 2002 Section 303(d) List. The Parsons/EPA study mentioned in the comments above (cited as Parsons/UA 2004 in this report) characterized several sampling stations along Spring Creek and Osage Creek in the Illinois River basin as "severely impacted" and "impacted". The results of that study showed that the sampling stations with the greatest level of impact were the same stations that had the highest phosphorus concentrations. The results of that study, along with other research and data for streams in this area, demonstrate that elevated phosphorus concentrations definitely contribute to aquatic life impairments.

The wasteload allocation for the City of Berryville for phosphorus presented in the TMDL is in conflict with the current Arkansas Water Quality Standards, and should be changed. The wasteload allocation cites the total phosphorus discharge limit of 2 mg/L for facilities with design flows of 1 to 3 mgd (APCEC Reg. 2.509). However, the wasteload allocation developed in this TMDL is the product of the facility flow multiplied by the 1.0 mg/L concentration that is not required until 2012 according to ADPCE rules. (APCEC, Reg. 6.) The effluent limitations and narrative standards at Reg. 2.509 are the Water Quality Standards for the state, not the 0.1 mg/L instream guideline that was removed during a previous revision; or the 1 mg/L limit outlined for attainment in 2012. The TMDL should be completed using the current 2 mg/L limit for the City of Berryville. At a minimum, implementation of the TMDL results into the permit should be phased, with a 2 mg/L based waste load allocation in the interim period and 1 mg/L based wasteload allocation effective in 2012.

Response: There are several important parts of Regulations 2 and Regulation 6 that are not considered in the comments above. APCEC Regulation 2.509 states that facilities with design flows of 1 to 3 MGD discharging into streams on the 303(d) list for phosphorus can have monthly average limits for total phosphorus **no greater than** 2 mg/L. This regulation does not prohibit a more stringent limit for phosphorus, which in this case is

required by Regulation 6.401. Regulation 6.401 states that compliance with the 1 mg/L limit for the City of Berryville "shall be attained **as soon as feasible**, but no later than January 1, 2012" (bold added here). The last sentence in the next to last paragraph of Section 2.4 of this report has been modified to clarify the time frame for compliance with the 1 mg/L limit for the City of Berryville. It should be noted that the endpoint used in this TMDL (0.1 mg/L total phosphorus in the stream) resulted in the same permit limit as specified in Regulation 6.401. This provides additional evidence that the endpoint used in this TMDL is reasonable.

The load allocation (LA) found in the TMDL is not consistent with the background load of phosphorus calculated in the report. In Section 4.6, background loading is calculated as the average annual flow (113.4 mgd) times average total phosphorus values from ambient monitoring station WHI0068 (Osage Creek upstream of the City discharge). The resulting background load for total phosphorus is 47.3 lbs/day.

In the TMDL report this background level is then simply compared to the load allocation, which was derived as the load remaining after the MOS and the wasteload allocation (WLA) was removed from the TMDL, to determine if non-point source (NPS) load reductions were necessary. If the TMDL process had been carried through to proper completion, the background load should have been subtracted from the TMDL along with the MOS and the remaining loading (17.24 lbs/day of total phosphorus) should have been allocated among point and non-point sources.

In this TMDL the background load is assumed to be the existing NPS load, and given that no NPS reductions are necessary, the remaining load should be available to the only existing discharger asked to make load reductions; the City of Berryville. Therefore, if the instream targets were assumed to be set correctly (see previous comments) the LA should be, at a minimum, set to the background loading and the WLA should be 37.26 lbs/day of total phosphorus.

Response: For clarification, it appears that "background" loading in the comments above refers to the total nonpoint source loading, which includes both natural background loading as well as nonpoint source loading caused by human impacts. The comments above appear to suggest that the load allocation for nonpoint sources should have been set equal to the existing nonpoint source load (47.3 lbs/day instead of 64.54 lbs/day) so that more loading could be allocated to point sources (i.e., so that the City of Berryville could get monthly average discharge limits higher than 1 mg/L). This suggestion is not feasible because the City of Berryville's allocated loading must be based on a

concentration no greater than 1 mg/L due to requirements in Regulation 6.

The determination of aquatic life impairment in Osage Creek, below the City of Berryville point source discharge (as described in the TMDL report), was made using data from three assessment reports. The first and second were completed by the Arkansas Department of Pollution Control and Ecology (ADPC&E) in 1992 and 1995, respectively, and the third was completed by EPA and Parsons in 2004. No aquatic life use impairments were detected downstream of the discharge in Osage Creek by the ADPC&E studies. Only the 2004 EPA/Parsons report cited impairments to the aquatic life use (several water quality indicators and macroinvertebrate and fish communities) downstream of the city discharge. Upon closer review of the EPA/Parsons report it was discovered that two sampling events for aquatic biota were completed. No impacts consistent with non-attainment of the aquatic life use were found to periphyton, macroinvertebrate, or fish communities during the first sampling event, but impacts to the fish and macroinvertebrate community were measured during the second sampling event. Note that an impact was noted to the macroinvertebrate community in Osage Creek downstream of the discharge, but use of a rapid bioassessment scoring system such as developed by Plafkin et al. (EPA, 1989), and used in the EPA/Parsons study typically allows a “slight impairment” while indicating full attainment of the aquatic life use.

The second sampling event occurred during a period when the stream was experiencing high flow such that macroinvertebrate samples could not be collected at the two reference sites (Osage Creek upstream of the discharge and the Kings River upstream of Osage Creek). Data was collected at the downstream sites both in Osage Creek and in the Kings River and then compared back to the reference data collected during the first sampling event over two months previous. Conclusions drawn from use of this data should be invalidated for two reasons. First, the sampling should never have been completed for fish or macroinvertebrates during this high flow event. High flows create dispersion in the aquatic communities making the sampling results much more spatially variable and limited in scope. Second, the macroinvertebrate community sampled during the second event cannot be legitimately directly compared to a sample from a different season for an impairment determination. The variable life cycles and seasonal distribution of macroinvertebrates is well documented in aquatic ecology. Any macroinvertebrate samples collected with this level of temporal variance will be assured to be different than the previous collection based on life cycles and season alone. A meaningful impairment determination could not be made using the data collected during the second sampling event.

Additional impairments are cited in the TMDL report and the EPA/Parsons report for diurnal fluctuation, low dissolved oxygen and oxygen saturation. Many of the results of concern presented in the report are not atypical of those of least disturbed reference streams in the Ozark Highlands Ecoregion (ADPC&E, 1987). In addition, no linkage is made in the study to these indicators and algal productivity or aquatic life impairment. Therefore, based on the analysis of the three studies cited in the TMDL report, it appears that Osage Creek below the City of Berryville discharge is maintaining the aquatic life use.

Response: The determination of impairment for this stream is not being based solely on the three reports identified in the comment. EPA's rationale for considering this stream to be impaired is given in the Decision Document for the Final 2002 Section 303(d) List for Arkansas (EPA 2003). Data from the Parsons/UA study were not used to determine impairments in Osage Creek below Berryville because data collection for that study did not begin until the late summer of 2003, which is after EPA finalized the Arkansas 2002 Section 303(d) list in June 2003. The Decision Document describes how EPA's determination of impairment for this stream included a review of various reports and other data such as DO and pH profiles.

Tyson is requesting to work with ADEQ and EPA on assessing the water quality impacts associated with indirect discharges from its Berryville Processing Plant via the City of Berryville POTW. In the event ADEQ and EPA determine the Berryville Processing Plant is contributing to water quality impairments, Tyson would prefer to develop additional voluntary procedures in lieu of developing a TMDL. If you have any questions related to these comments please contact me at (479) 290-7541 or John Couch at (479) 986-1276.

Tyson Foods would like to request a meeting with EPA to further discuss and clarify the points made above. Tyson requests that such a meeting be scheduled prior to the potential adoption of a TMDL for the Osage Creek. My contact information is listed below.

Response: After these comments were received, EPA discussed these comments with the author of the letter by telephone on December 14, 2005. EPA will gladly discuss the TMDL with Tyson Foods further and answer any questions concerning the TMDL.

COMMENTS FROM ARKANSAS DEPARTMENT OF ENVIRONMENT QUALITY:

The Water Division staff has completed its review of the following draft TMDLs: Nitrate and Phosphorus in Rolling Fork; Phosphorus in Osage Creek near Berryville, Ar.; Phosphorus, Copper and Zinc for the Poteau River near Waldron, Ar.

Our comments are as follows:

In each of these studies, the value utilized as the phosphorus removal target is not a numerical water quality standard. In previous versions of Regulation #2, phosphorus was mentioned as a guideline, but was not--and is not--technically defensible due to varied (by ecoregion and individual watershed) responses by aquatic communities to instream

nutrient concentrations. As a result, this guideline has since been removed in Arkansas' current water quality standards. TMDL validity must be based on addressing documented violations of existing Arkansas water quality standards and impaired use.

Response: The TMDL in this report is being established to maintain Arkansas' narrative criteria for nutrients. Establishing a TMDL to comply with narrative criteria requires the development of a numeric endpoint. The endpoint for this TMDL is an estimate of the phosphorus that the stream can have and still maintain the aquatic life designated use. The 0.1 mg/L endpoint used in this TMDL was considered by EPA to be a reasonable goal that is not overly stringent. If a more appropriate numeric endpoint developed in the future, this TMDL can be revised at that time.

EPA agrees with the statements above that aquatic life impairments are usually due to a number of other factors in addition to phosphorus concentrations. The list of factors quoted above is presented in Regulation 2 for the purpose of determining impairment rather than developing TMDLs. The determination of impairment for this stream did rely on several different factors as documented in EPA's Decision Document for the Final 2002 Section 303(d) List for Arkansas (EPA 2003). The TMDL in this report is focused on phosphorus concentration as the endpoint rather than on other indicators of aquatic life impairment (e.g., large diurnal fluctuations of DO and pH, etc.) because the 303(d) listing for this stream cited phosphorus as the major cause of impairment. Other indicators of aquatic life impairment are often the result of elevated phosphorus concentrations.

The comments above state that aquatic life is not impaired in some streams that have phosphorus concentrations above 0.1 mg/L, such as Osage Creek in the Illinois River basin. EPA disagrees with this specific example. EPA considers aquatic life to be impaired in Osage Creek in the Illinois River basin, as indicated by EPA's addition of that stream to the Arkansas 2002 Section 303(d) List. The Parsons/EPA study mentioned in the comments above (cited as Parsons/UA 2004 in this report) characterized several sampling stations along Spring Creek and Osage Creek in the Illinois River basin as "severely impacted" and "impacted". The results of that study showed that the sampling stations with the greatest level of impact were the same stations that had the highest phosphorus concentrations. The results of that study, along with other research and data for streams in this area,

demonstrate that elevated phosphorus concentrations definitely contribute to aquatic life impairments.

Specific comments include (1) the stream segment below the Tyson discharge to Rolling Fork has had the domestic water supply source designation removed, thereby invalidating the instream TMDL target for nitrate-nitrogen, (2) the current 303d listing for metals in the Poteau River at Waldron is in the 5c category, which indicates questionable data due to QA/QC procedures, and may be resolved due to refinement of sampling techniques, and (3) the Osage Creek TMDL (Berryville) contains numerous errors, erroneous data and inaccurate loading calculations.

Response: The comment concerning this report does not list any specific errors to be addressed nor does it provide any substantiated evidence of errors in the report. EPA and the contractor have reviewed this report and have not found errors. Comment 1 above is addressed in the separate document, "TMDLs for Nitrate and Phosphorus in Rolling Fork." Comment 2 above is addressed in the separate document, "TMDLs for Phosphorus, Copper, and Zinc for the Poteau River near Waldron, AR."

All three of these point source dischargers have voluntarily agreed to develop/utilize technologies that effectively reduce nutrient loads to the receiving streams. ADEQ commends their willingness to initiate these procedures that will serve to enhance the protection of the instream aquatic communities, and prefers this approach to potential requirements dictated by technically invalid TMDLs.

The Water Division looks forward to continuing our long-standing working relationship with EPA. If you have any questions regarding the above comments, please feel free to contact me.

Response: EPA also commends the City of Berryville for voluntary efforts to reduce nutrient loading to Osage Creek. This TMDL imposes the same limits as Regulation 6 on the City of Berryville.

COMMENTS FROM UPPER WHITE RIVER BASIN FOUNDATION:

I write on behalf of the Upper White River Basin Foundation to express concerns over the proposed TMDL for Osage Creek near Berryville, Arkansas. Specifically, I have concerns about the quality of information the EPA has relied upon as part of the assesment of this basin.

The Upper White River Basin Foundation was founded for the sole purpose of making the lakes along the Upper White River the cleanest lakes in North America. As part of

that mission, the Foundation secured a Watershed Initiative Grant from the EPA during the innaugural year of that program. A portion of those funds were used to contract FTN Associates to conduct the "Kings River Watershed Assesment" which is cited in the draft FTN submitted to the EPA.

The work done by FTN Associates on the "Kings River Watershed Assesment" can only be described as extremely poor in quality and content. That report was rife with errors, of extremely low quality, and so inadequate that it really cannot and should not be relied upon by anyone. To the extent that FTN Associates' work on the assesment was used as any kind of basis for the draft TMDL is to call into question the validity of the TMDL draft itself.

While we are certainly supportive of improving the Kings River watershed, and recognize the need for improvements in the wastewater treatment abilities within that watershed, I would be remiss if I did not bring our serious concerns about the FTN report to the attention of the EPA.

The Foundation has worked closely with the EPA to direct a significant amount of grant dollars into the Kings River watershed, and we look forward to a continued partnership as we work together to improve that watershed. However, decisions on how to best make a difference in the water quality of the Kings River must be made on sound science. Our experience with FTN Associates on the Kings River calls into question the vailidity of the science on which they have based their report.

As a result, I urge the EPA to seek more information and verifiable data in order to have a draft TMDL based upon sound science. Until such time as the information relied upon is accurate and meets professional standards, the EPA should not approve the current draft TMDL for Osage Creek near Berryville, Arkansas.

Response: These comments do not list any specific errors to be addressed nor do they provide any substantiated evidence of errors in the information from the Kings River Watershed Assessment. EPA and the contractor have reviewed the information that was taken from the Kings River Watershed Assessment and have not found errors. The Upper White River Basin Foundation has not communicated any findings of error to FTN Associates for the final version of the Kings River Watershed Assessment report submitted in August 2005.

This TMDL simply confirms the requirements for the City of Berryville that were already in Regulation 6, providing further evidence that this TMDL is reasonable and is based on sound science.